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AUTHOR	Znamenskaia, Elena; Guan, Yi; Young, Michael F.	
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ABSTRACT

This paper is based on observations of ten middle and high school science teachers in a multimedia workshop during the fall semester of 1997 in a large Northeastern public university. The workshop objective was implementation of multimedia technology in teachers' classrooms. The following methods were employed in this project: multimedia portfolio assessment, field notes, interviews, and questionnaires. Results were viewed from the situated learning perspective. Analysis revealed the following: teachers experienced positive conceptual change in their perception of PowerPoint, from it being a tool for teachers to it being a tool for students; goals of participants changed from more general to more specific; participants' confidence in video and computer skills improved; a collaborative environment developed among participants; participants showed emotional attachment to their workstations; teachers' reported understanding of the educational value of QuickTime movies improved; teachers' understanding of the educational value of PowerPoint presentations did not change; and teachers developed dependency on workshop staff. Nine tables illustrate the confidence decision tree from the information processing point of view, and results of selected questionnaire and interview responses. (Contains 25 references.) (Author/DLS)

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Teacher In-Service Multimedia Training:

A View of Outcomes from a Situated Learning Perspective

Elena Znamenskaia, Yi Guan, and Michael F. Young

University of Connecticut

A version of the research described here was presented at the annual AECT National Convention, Houston, TX, February 1999. Direct correspondence to the first author, Elena Znamenskaia, Department of Educational Psychology, UConn, Box U-4, 249 Glenbrook Rd, Storrs, Connecticut, 06269-2004, elz94001@uconnvm.uconn.edu.

Abstract

This paper is based on observations of ten science teachers in a multimedia workshop during the fall semester of 1997 in a large Northeast public university. The workshop objective was implementation of multimedia technology in teachers' classrooms. The following methods were employed in this project: multimedia portfolio assessment, field notes, interviews, and questionnaires. Results were viewed from the situated learning perspective. Analysis revealed the following: teachers experienced positive conceptual change in their perceptions of PowerPoint, from it being a tool for teachers to it being a tool for students; goals of participants changed from more general to more specific; participants' confidence in video and computer skills improved; a collaborative environment developed among participants; participants showed social attachment to their workstations; teachers' reported understanding of the educational value of QuickTime movies improved; teachers' understanding of the educational value of PowerPoint presentations did not change; teachers developed dependency on workshop staff.

Teacher In-Service Multimedia Training:

A View of Outcomes from a Situated Learning Perspective

This paper is based on observations of ten in-service science teachers involved in a multimedia workshop during the fall semester of 1997. It took place in the multimedia laboratory of the chemistry department at a large Northeastern public university. The workshop was sponsored by the State's Department of Higher Education. The primary objective of the workshop was for teachers to successfully implement and use multimedia technology in their classrooms. It was designed to help ensure implementation of cutting-edge multimedia technology in the science classrooms to improve teaching processes. Participants were asked to improve their understanding of science through the preparation of a computer-based presentation with images, digital video clips, text, and equations.

The workshop was conducted over 14 weeks, three hours in the evening each week for one semester. State-of-the-art multimedia equipment was provided by the chemistry department multimedia laboratory. Multimedia equipment included but was not limited to: six multimedia computers, four digital video cameras, one SVHS and one 8-mm video camera; two color scanners, three CD-ROM recorders, two videodisc players, and three VCRs. Of six computers five were Macintosh Quadra 950s, 68040 machines, and one was a Power Mac 8100/80. All computers had fast external array drives for capturing digital video clips and two video boards. The first board was the usual built-in computer-video, while the second one was for digital motion-video, Radius Video Vision Studio (VVS). One of the computers was used as a server to store final products and make them available on the Internet for the teachers' use in other schools.

The workshop's format included lectures on the use of multimedia software during the first six sessions; discussions of goals for each session, problems, and suggestions; individual or team hands-on work on secondary science topics selected by the teachers; and presentations given by them in the middle and at the end of the semester. The workshop staff included one university chemistry professor, and two graduate students. One graduate student was from the chemistry department. The other, who was also collecting data for this research project, was from the department of educational psychology. Teachers were presented multimedia and presentation software including Adobe Premiere, Adobe Photoshop, and Microsoft PowerPoint. Training was provided in cutting-edge multimedia techniques that integrate digital video with still images, text, graphs, and equations. Teachers were not only taught how to use state-of-the-art multimedia equipment to prepare these materials, but also how to modify their techniques to use less capable computers that were available at their schools, while maintaining most of the benefits of multimedia technology. Materials developed by participants were organized onto CD-ROMs that they took home during and at the end of the workshop.

Another major emphasis of the workshop was the interactive relationships between workshop staff, teachers, and school students. Participants were encouraged to work on their projects in small groups/pairs. Teachers developed multimedia materials during the workshop sessions. Then these materials were tested in teachers' own classrooms between workshop sessions. Some teachers set up experiments right in the laboratory during the workshop sessions and video taped them for later capturing as digitized clips on the computers. Some teachers involved their students in video taping of lab procedures and/or experiments in their classrooms, so that the teachers were using these tapes for capturing digitized clips on the computers during the workshop time, and were bringing these clips on the CD-ROMs back to their students for use in students' PowerPoint presentations. Experience gained in the teachers' classrooms was then used in an interactive feedback process with other participants and workshop faculty each week.

Theoretical background

All workshop activities were viewed in this project from the situated learning perspective. The theory of situated learning emphasizes the importance of interaction between agent and environment (Gibson, 1977, 1986). According to Dewey (1938) "interaction is going on between an individual and objects and other persons. The conceptions of situation and of interaction are inseparable" (p. 43). Each person's interaction with their environment is unique. In this project, for each of the workshop activities, there could be considered different kinds of interactions, such as interactions of individuals or teacher dyads working with the computer and interactions of experts (workshop staff) with novices (workshop participants) working in a problem situation. Interactions of teachers with their school environments can be viewed as an important part of transfer of their experiences from the workshop situations to the classroom situations.

Learning

Learning is viewed from the perspective of situated learning as a perceptual attunement to different environmental affordances, rather than the acquisition and storage of information (Gibson, 1986; Greeno, 1989). From this point of view, learners' ability to detect information in a learning environment increases "with practice and the education of attention" (Gibson, p. 254). Thus, learning is an active process of interaction of learners with the environment.

Learning is usually more effective when it occurs in a rich interactive environment where experts and novices learn together in collaborative apprenticeships (Brown, Collins, & Duguid, 1989; Collins, Brown, & Newman, 1989; Lave & Wenger, 1990). Critical importance is given to social interaction, social construction of knowledge, and collaboration of learners. Cognitive apprenticeships also suggest the paradigm of situated modeling, coaching, and fading, whereby experts promote learning. In other words, cognitive apprenticeship methods try to enculturate learners into authentic practices through activity and social interaction.

Most of the learning during the workshop occurred through interaction of experts (workshop staff) with novices (participants) working with computers. A hypothetical learning situation analogous to the workshop situation was described by Shaw, Fadar, Sim, and Repperger (1992) and later by Young, Kulikowich, and Barab (1997) in which the instructor or expert has a goal which is being transferred to a learner by coupling their actions. They go through numerous trials. The instructor provides continuos feedback (to learn the goal), and in turn receives a feedback from the learner to decide when to fade. Eventually the instructor is able to fade control and simply monitor learner's actions. During this process of coupling, the learner adopts new goals from the instructor and modifies his/her own goals accordingly.

Problem solving

Most of the workshop activities were hands-on experiences with computers and different multimedia and presentation software. There were no specific problems set up for teachers to solve. Nevertheless, some problem solving was expected from the participants in pursuing their goals. Problem solving can be viewed as an interaction process from the situated learning point of view. In this case, it is an interaction between the problem solving skills of the individual problem solver and the activities that a particular problem affords (affordances). According to Kugler, Shaw, Vicente, and Kinsella-Shaw (1991), a problem solving activity is an interaction of attractor sets provided by a complex realistic context, affordances, and the attractor processes, effectivities, by which problem-solvers achieve the goal-states set up by the problem solving intentions. As a result of this interaction, new sub problems are discovered and new plans and goals are set up.

Problem-solving situations created based on the theory of situation learning are characterized at least by the following features (Young & McNeese, 1995): problem solving requires the coordination of multiple cognitive processes; it occurs within complex contexts; it is interpersonal; it requires social construction of knowledge; it is often ill-structured and requires generation of relevant sub-problems; it involves the integration of distributed information; it takes place across extended time frames; it involves several possible competing solutions; it involves detecting relevant from irrelevant information; and it involves intentions and goals that often have personal and social significance. Existence of all or some of these features in problem determines effectiveness of the problem solving processes and possibly transfer from one situation to another one (CTGV, 1993).

Experts vs. novices

One of the major types of interactions during the workshop was between experts (workshop staff) and novices (workshop participants) working in a situation. From the perspective of situated learning, experts are the ones who are attuned better to the affordances of the multimedia tools through practicing and attending to what they do. Novices have a disadvantage of practice in the same domain as experts and their attention to affordances is not as good as that of experts. According to Flach, Lintern, and Larish (1990), "... skill depends on both event structure and actor attunement. The problem for the novice is to discover the functionality of event structures and to respond to those structures that map most directly to task objectives" (p. 351). Any task environment can be described in terms of a nested array of event structures. If no such structure exists, the actor is left to flounder among the "noise" and little improvement with practice can be expected.

In the case of this workshop, experts were interacting with novices within a situation. This interaction is, according to Shaw et al. (1992), a dual process of perceiving and acting by both experts and novices. The novice keeps practicing until the moment when his/her attempts "require no corrective (felt) feedback from the instructor for three successive repetitions" (Shaw et al., p. 10).

Confidence

From each workshop participant confidence self-reports about computer, science, and video skills of workshop participants were collected. According to most cognitive theories, confidence can be defined as capability beliefs of a person about any of a number of personal strengths or weaknesses: perceptual, motor or communicative skills (Ford, 1992). Definition of confidence through capability beliefs is also close to Bandura's (1986) understanding of self-efficacy as a judgment of one's capability to accomplish a certain level of performance. When asked about his/her confidence, the way a person might come to understand if (s) he is confident about doing some specific task or using a computer in general, could be considered as a process of working through a decision tree. Thus, between the moment when a person stops reading a question about his/her confidence level and starts writing down or circling the response, different cognitive processes happen as it can be seen in Table 1.

Insert Table 1 here

From the situated learning perspective, the process of answering questions on the confidence scale can be explained by the prospective perception (Gibson, 1986) of the difficulty of the task. Processes of perceiving are emphasized in this case rather than the memory-related processes as in the information processing perspective. These perceptual processes cannot be depicted as a structured liner model of going from one stage of the decision tree to another one as it can be done for the information processing processes. It is rather a model of multiple-layered perception-action cycle[1]. Generally prospective perception is driven by some goal and the future is directly perceived by an agent. In this case this process is constrained by the goal to put a mark on one of the circles, a process of direct information pick-up from reading each item on the survey, and a process of direct perception of how well the agent will do the task in the future. The agent/person will put a mark, which will vary from one to five on the Likert scale.

<u>Transfer</u>

The transfer of knowledge from one situation to another one is important proof of any learning. In the case of this workshop project, one of the major goals was an implementation by teachers of the multimedia materials and learned software into their schools. In other words, transfer of the experiences from the workshop situations to the classroom situations was an important part of the workshop. From the situated learning perspective (Greeno, Moore, &

Smith, 1993), transfer of a learned activity to a different situation "involves a transformation of the situation and an invariant interaction of the agent within the situation... Transfer can occur if the structure of the activity is invariant across the transformation from situation 1 to situation 2 with respect to important features that make it successful, or if a needed transformation of the activity can be accomplished" (p. 102). For transfer to occur, the instruction should influence any activity so that it includes attention to affordances that are invariant across changes in the situation.

Assessment

Portfolio assessment was employed in this project based on a theoretical understanding of teachers as intentionally driven systems, with portfolios capturing changes in their goals across time. According to Moeller (1995), a portfolio is "a purposeful collection of student work that tells the story of the student's efforts, progress, or achievement in a given area. This collection must include student participation in selection of portfolio content; the guidelines for selection; the criteria for judging merit; and evidence of student self-reflection" (p. 106). Portfolios emphasize process as much as product and adapt better than any linear assessment to the complexity of the agent-environment interaction (Young, 1995). This kind of assessment can be used to evaluate performance in the context of collaborative groups as well as changes in performance of individuals.

Depending on the purpose of portfolio collection, a portfolio can include either the best of the learner's work; some selected work according to specific criteria; or all of the work collected over the period of time. Thus, for example, one of the reasons to have a collection of all work is to determine changes in the skills of a learner. For in-service teachers, the use of portfolios for professional development can be a form of self-confrontation (Hale & Kieffer, 1995). Also, the process of creating portfolios can encourage change through reflection and evaluation.

Although portfolios have a big advantage over traditional types of assessment in reflecting the chaotic nature of real learning, there are some concerns with this form of evaluation. One major concern is time. It takes time to review portfolios and furnish feedback. Another concern, related to the first one, is that of reliability and validity. In addition, some believe that reliability and validity of portfolios are tenuous at best due to difficulty (Sparapani, Abel, Easton, Edwards, & Herbster, 1996).

Initial research questions

Since this was primarily a qualitative study, it was focused on, but not limited to, the initial research questions. These were:

1. How do computer, video and science skills of participants change over the period of one semester and during each workshop session?
2. How does each participant's confidence change over the period of one semester?
3. How do the goals of participants change during this workshop?

Participants

Workshop participants were recruited from middle and high schools from six school districts via flyers and phone calls to school administrators. The only prerequisites for taking this workshop were familiarity with computers and a desire to learn and implement multimedia software in future teaching. Due to the hardware limitations, the original number of participants was limited to 12 science teachers. Two people dropped the workshop at the beginning (one of them was a first year teacher and it was too much pressure on her to continue the workshop).

Two other people dropped it one month prior to the end of the workshop due to practical constraints (as they indicated earlier, they did not see how they would implement this technology in their schools with a very limited number of computers)[2]. Teachers, three females and seven males, were of diverse teaching experience ranging from three to 28 years of teaching chemistry, biology, environmental science, botany or general science.

Methodology

Both quantitative and qualitative methods were employed in this project. During the first workshop session, teachers were informed that their participation in the project was voluntary and that their responses, as well as any other information, would be kept confidential should they choose to participate. All teachers chose to participate in the project.

Pretest and posttest questionnaires were administered during the first and the last sessions of the workshop. This instrument for surveying participants was designed to assess teachers' goals and conceptions of multimedia using open-ended questions. Also, a 5-point scale was used for assessing teachers' confidence in computer, video, and science skills. Since two people dropped the workshop a month prior to the end of it and some people took just the pre or the post test, only five complete sets of pre and post questionnaires were considered for this research.

Multimedia portfolio assessment was used as a part of the weekly data collection. The teachers were told to organize their weekly work (digital movie clips, still images, scanned pictures, and drawings/graphics) in separate folders with their name and date on them. The intent and initial rubrics of the portfolio assessment were shared with the participants at the beginning of the workshop. The rubrics were slightly modified later by researchers and finalized after review by an independent examiner. These final rubrics were used for an independent data interpretation by two researchers. An overall percentage of consistency for all participants[3] for determining the purpose of the movies was 99.5%, 98.8% for determining the extent to which the movie was needed to show this, and 87.0% for determining the quality of the movies.

Field notes from each workshop session were taken by one of the workshop staff members. Short, about 15 minute, structured interviews with participants were conducted by two researchers at the end of the semester and transcribed after the end of the workshop.

Results and discussion

Review of both qualitative and quantitative data revealed the following common themes across all data types: participants experienced positive conceptual change in their perceptions of PowerPoint, from it being a tool for teachers to it being a tool for students; goals of participants changed from more general to more specific and/or realistic ones; participants' confidence in video and computer skills slightly improved; a collaborative environment developed among participants; participants showed some social attachment to their workstations; teachers' reported understanding of the educational value of video clips (QuickTime movies) and the appropriateness of their use improved; teachers' reported understanding of the educational value of PowerPoint presentations did not change, most of them left with superficial conceptions of the use of PowerPoint presentations; teachers developed some dependency on experts. There was little evidence available to answer the first research question concerning whether computer, video and science skills of participants changed over the period of one semester. Findings are discussed below in more detail.

Focus on tools for students

The review of responses to item 3 of the questionnaire (What do you think makes a good classroom presentation?) revealed some positive change in participants' perceptions of PowerPoint from being a tool for teachers to a tool for students. Of five respondents two teachers' perceptions changed (see Table 2). One of the teachers responded on the pretest about what a good classroom presentation should be: "... one that keeps students' interest, is educational + fun, using manipulatives." Another person said that the important part of a presentation is a, "computer simulation that would keep students interested." These responses as well as the ones of other people dealt more with the surface structure of the PowerPoint presentations as a tool for teacher's use. The same people gave different responses on the posttest. The first teacher's response was: "... students interested in a topic, engaged in activity and making info "their own" (more personal)." The second person emphasized this time "text material, probing questions, multimedia technology, interaction between students and teacher." These sounded more like attempts to involve students into classroom presentations.

Insert Table 2 here

Field notes and interview responses supported this conceptual change in participants' understanding of PowerPoint presentations as a tool for students not just for teachers as supported by notes from Session 8: "J. tells about how she already started involving her students in video taping some biology processes and making multimedia reports as a part of their examinations. D. wants his students to go through the process of flying to understand four forces (it is easier for students to understand concepts that they wouldn't see/understand otherwise)." In his interview one of participants said: "As I said I have some students that were taking the labs and then putting it into the PowerPoint presentation to present it to the class. So it was like a summary of the lab that they did."

This finding supports the idea of the dual effects technology has on users (Solomon, Perkins, & Globerson, 1991). The first meaning of effects concerns changes in performance with technology, while equipped with it. This can be linked to the use of PowerPoint by teachers as their own tool for teaching. Effects with technology are obtained during an intellectual partnership with it. Another meaning of effects concerns relatively lasting changes in performance as a consequence of interaction with technology. This meaning can be linked to the use of PowerPoint not only by teachers themselves but also as a tool for learning transferred to the students. In this case, effects of technology show up in the ability to make this transfer of the intellectual partnership of humans and technology. The fact that workshop participants started using PowerPoint not just as a tool for their own teaching but brought it into their classrooms is important proof of the transfer of this human-technology intellectual partnership to their students.

Goal changes from general to specific or more realistic

All data showed a tendency of goal changes from more general to more specific or realistic ones over a period of the workshop. Some goal changes were expected according to the review of the literature on situated learning. Since most of the workshop agents and environments were considered to be changing over a period of time (Gibson, 1977; 1986), it was logical to assume that the goals of participants would change too.

During the review of the data two major reasons for goal changes of teachers were identified: 1) course expectations and 2) practical constraints. This is what one of the interviewees said how his goals were changed by the course expectations: "At first my idea was, I just sit here for a while, just absorb stuff. I realized that this is not what Dr. X. has in mind at all. He expected me to do something besides sitting here, listening, watching, and quietly learning. But as I got into it, that was good. So I began to think about what I could work on, and pushed myself to do things on the computer... So, my goals changed. I wanted to do something for myself and I wanted my class to be involved. I wish I had been able to get some kids interested in doing video. I could have done that in class, but I sort of ran out of time." Here is what another person said in her interview: "When I came in, I wasn't thinking about projects, I was thinking about videos, we had to do videos... Actually, it was not my focus. So, interesting, I really wish I could have focused more quickly on what I really wanted to do... I guess as time went on, I became aware of the fact that I need to focus more on projects. My goals changed from focusing on the video which seems to be something I thought I had to do, and I focused more on making usable presentations with still photos. So, my goals did change, I think." This type of goal change is consistent with expectations about how learning occurs in expert-novice interactions described by Shaw et al. (1992) and Young et al. (1997).

Another reason for goal changes (practical constraints) was discussed in the field notes from workshop session 9: "B. wants to work on a presentation about fish feeding behavior, wants his students to see this process (cannot use any high tech. equipment, no computers are available), says that mostly he is taking this workshop for fun because he doesn't see right now how it will be useful for him. The only thing he can do is to capture a slow down of the process on the computer and then capture it back on the video tape along with the presentation." This finding seems to support Cain's (1995) idea that new technology forces teachers to use computers not just as typewriters with memory but as tools to improve their teaching and student learning. Similarly, teachers are facing some practical constraints of not having enough computers (Dockterman, 1991) or having less powerful computers: "This leads to problems with scheduling sample computer time for students use which in turn deters teachers from attempting to incorporate computers into their daily plans" (Cain, p. 17).

The review of the questionnaire responses to question 1 (What would you like to learn about multimedia software and computers to effectively create a multimedia presentation?) also supported the idea about goal changes. The goals of one teacher changed over a period of time (see Table 3). An example of a general goal on the pretest would be to learn "whatever I need to know to use software to effectively create a multimedia presentation." An example of a specific response on the posttest was to get "greater confidence with inserting photos and video clips."

Insert Table 3 here

The review of CD-ROM materials revealed that the goals of four out of eight people (working as one dyad and two individuals) became more realistic. Their QuickTime movie sizes changed from big at the beginning of the workshop period to small by the end of it. No change of size was found in the movies of two other participants. It can be considered as a positive finding since their original movies were small too. No change of size was found for another pair of participants, but in this case the findings were inconclusive since there were no records of their work for the last month of the semester (the size of their movies in the beginning of the semester was small/medium).

In reviewing interview responses and field notes, there were found a couple of negative cases with no goal changes. Here is what one of the participants with no goal changes said: "I pretty much came in with the goal and then I did a few extra things while waiting to get materials I needed for the final one."

Increase in confidence about video skills and computer skills.

The review of field notes and interview responses revealed that while participants' confidence in video and computer skills slightly improved, science skills did not change. The notes from session 10 present an example: "P. seems to be more and more confident with PowerPoint and computers in general, so that he even starts helping others." One of the participants said in her interview that she became "definitely more confident" about the computers skills. Another person said he felt "absolutely more" confidence in video skills. Almost everybody felt this way in their interviews (see Table 4).

Insert Table 4 here

In their interviews teachers reported becoming more confident about the use of computers and video, but this finding was not supported by their questionnaire responses. Their changes in confidence shared no significant differences judged by z-scores (see Table 5 and Table 6). These results could be partially attributed to a small sample size.

Insert Tables 5 and 6 here

Collaborative nature of relationships among participants

Field notes and interview responses showed the collaborative nature of the relationships among participants. Some degree of collaboration was expected among participants of the workshop. Unfortunately, most of the teachers had individual projects and were too busy working one on one with computers. They were helping each other but not working/learning together in groups of cognitive apprentices, which would have promoted more collaboration, according to Brown et al. (1989); Collins et al. (1989); Lave et al. (1990). This is what was observed by one of the researchers during session 2: "G. is the only one who worked with an S-VHS camera before, he explains something to his partner, she helps a guy next to her to deal with his camera... J. assists P. G. helps S. and H. (they make a movie with microscope). G. and J. help to set up a camera and a tripod (they don't shoot their own video, said that they know how and just want to see what everybody else is doing)."

Here is what one of the participants said in her interview: "I think every one was very communicative. I think they were very helpful. At no time I felt as if some one wasn't willing to help me. Every one was willing to help."

Although most of the people felt that the workshop participants and staff were always ready to help, and that the collaborative rather than competitive atmosphere was created, one person did not feel this way. Some evidence of that could be found in the observational notes from session 6: "P. and D. didn't know how to share the computer, Dr. X suggested they would help each other, so they started capturing some movies from the video tape (for P.'s presentation). It seems that this collaboration didn't work out, because D. moved to another one after a short while." This is what the same person said in the interview: "... frustration, I was just not having access to computers every time to work on the things. I wish I was here with partners, we would be working on the same things. Every time I felt I was here, I was not being productive."

Social attachment

Observational notes revealed that all workshop participants showed some social attachment to their workstations. Here is what was observed during session 8: "S. finishes making and editing pictures, starts walking around looking for what others do (he did his work on a computer connected to a scanner). He seems to be unwilling to keep working on another computer... D. and M. don't know what computer to use (their computer is in use today). In session 10 and session 13, the similar patterns show: "J. goes right to her computer, connects the video camera, and starts capturing more movies. Stan moves to the computer he usually works on ..."; "J. connects her video camera to the computer she has been usually using, starts making more QuickTime movies..."

These "territorial" patterns can be explained by the fact that an individual most likely treated his or her computer as a teammate. These feelings of "teamness" are very powerful and affect people's interaction with their computers, and people rely on them for their own success (Reeves & Nass, 1996). Considering a computer being on the same team "encourages people to think that the computer is more likeable and effective, and it also promotes cooperation and better performance (Reeves & Nass, p. 160)". The social attachment to a computer observed in this workshop reflects such effective partnership between human and computers.

Preference of video clips vs. still images for showing dynamics of processes

Video is designed not only to produce a realistic image of the world around us, but also to manipulate temporal and spatial perspectives (Heinich, Molenda, & Russell, 1993). Three basic attributes of motion media or videos are stated by Heinch et al., manipulation of space, alteration of time, and compression of time. Primarily, videos "permit us to view phenomena in microcosm and macrocosm, that is, at extremely close range or from a vast distance" (Heinich et al., p. 195). Videos also "show movement through space in continuos time and far faster than we could possible move in reality" (Heinich et al., p. 195). In addition, video can compress time that it takes for an event to occur, such as showing images of flowers slowly opening (Heinich et al.). All three attributes are important features for educational use of videos.

Responses to the questionnaire revealed an improvement in teachers' understanding of the educational value of the video clips (QuickTime movies) and the appropriateness of their use. The results of the answers given to question 4 of the questionnaire (What content is best displayed using video rather than still images?) showed that only one of five people on the pretest clearly indicated how the video clips should be used. Four out of five people gave a better reason for using QuickTime movies on the posttest (see Table 7). Here are some responses given on the pretest about what should be displayed best using video rather than still images: "experiments, fieldwork" (vague answer); "any material that is attempting to demonstrate a process, rather than a structure or fact (change over time), examples - evolution, erosion, succession, etc." (Dynamics of process). Here is one of the examples of the improved responses given on the posttest: "experiments/content showing movement, example - showing diffusion of substance in H_2O or trajectory in physics".

Insert Table 7 here

The same positive change in understanding was shown in the field notes. For example, here is what it says in the notes from Session 13: "He (G.) thinks that the decision about use of short clips or stills has to be always made. Some topics are better discovered through motion, some are good to see on stills".

However portfolios show no evidence of improvement in the quality of the video clips actually produced in the beginning and at the end of the workshop. Even though the workshop was a hands-on, it appears to have produced positive conceptual change but had little effect on the transfer to production quality.

For an activity learned in one situation to transfer to another, the second situation has to afford the same or similar activity and agent has to perceive the affordances constrained by the structure of the activity invariant across situations. An agent also has to have an ability to react upon the affordances and engage in the activity (Greeno et al., 1993). In this workshop, the lack of video quality transfer might be due to at least one of three reasons. First, the sample video clips that the instructor used for demonstration of the video production might not have been of high production quality. Second, the activity in the workshop might not have encouraged participants to design good quality videos. Third, participants might not have been tuned to the attributes (affordances) of a good video, and, therefore, their ability of producing a good video might not have been learned. The first reason was eliminated after evaluating the quality of instruction video clips. Their quality turned out to be high. Thus, little transfer in production of video clips might be due to two other reasons mentioned earlier.

<u>Superficial conception of PowerPoint use</u>

Notes and interviews revealed little change in teachers' understanding of the educational value of PowerPoint presentations. They left with superficial conceptions of the use of PowerPoint presentations. This is what one of the teachers said about it: "We have two different types of computers and two different versions of PowerPoint. So, I will go through every step of what they should be looking for, what kinds of things they should be doing. I am hoping that will help them a lot. And from what I know about my kids, ... I think they will have a great time with it". Here is what it says in the notes from session 13: "P. recommended Dr. X. to get a newer version of PP because kids are interested in all the sound and animation effects that newer version of PP for Windows has."

Responses to the questionnaire (Question 3: What do you think makes a good classroom presentation?) also showed that most of the teachers did not understand the educational value of

PowerPoint (see Table 8). What teachers thought was important about a classroom presentation was that it, for example, "captures the students' attention and demonstrates what you want them to see" (pretest). The same types of responses were given on the posttest: "Material must be current and appropriate for the class, must have "eye appeal," must be short - "too long bores them." Another person emphasized "color, readability, photos, few words and more images, professionalism, control of space."

Insert Table 8 here

Low total number of PowerPoint presentations in the multimedia portfolio collection of every teacher also supports this fact. The average number of presentations per group or individual project was 1.7 which shows that probably all participants didn't get enough exposure to PowerPoint to have a deeper understanding of its educational value.

Although most of the teachers left with a superficial understanding of PowerPoint, two people had some good thoughts about this issue. Here is what one of them said in her interview: "They are going to use that and make slides and make presentations when they will talk about what went on. This is just another form of assessment. I think it is much better than the test. They really have to be able to explain what's going on. So the assessment itself I think is much better than the standard forms." Here is what it says in the notes from session 14: "D.: Kids were taking videos for this presentation and were supposed to analyze processes from the physics point of view." These findings might be due to the fact that workshop experts had the superficial conception of PowerPoint, limiting it to just being a tool for drawing students' attention, having good readability, presenting organized layout, and so forth. However, the true value of using PowerPoint is that it is an effective tool for improving students' learning performance (Solomon et al., 1991). It is a tool with which students gain ability of using the PowerPoint application as well as a tool with whose assistance students learn.

Dependency on workshop experts

Although several teachers entered the workshop considering distributed sources of knowledge, participating in the workshop seemed to narrow their focus to seeking help only from workshop staff. Initially participants list books, help files and other teachers as knowledgeable resources.

The review of observational notes and interviews revealed that workshop participants developed some dependency for information on experts, in this particular case, on workshop staff. The responses to question 2 (Where would you look for help when constructing a multimedia presentation?) showed that two people on the pretest and three people out of five on the posttest wanted to consult experts (see Table 9). Here are some responses: "Chemists and universities (media experts, this course?!" (pretest), "C-Teams", and "X. or E."

Insert Table 9 here

The notes from session 7 also showed dependency on workshop staff: "S. and D. look helpless when they cannot detect a problem. S. and D. ... keep doing something with the computer, checking wires, shutting the computer down, turning it on several times, look around for help, ask why there is no icon for the array drive on the desktop. Dr. X. helps them to find the problem..." The evidence of this dependency can also be found in teachers' interviews: "First of all X. is a resource, he seems to be more than willing to... He came to our school one time. He is more than willing to help us. He will come to our school when we receive our new equipment this week... So, again for my own sake, because I have low expertise I would have liked to have someone just give me a task I have never tried before, especially capturing video, try a simple little thing and then come back to see how it goes. So, may be a little guidance, directed guidance, I guess..."

Although most of the people showed some dependency on the workshop experts, a couple of participants also mentioned their peers as a source of help in designing a multimedia presentation: "Also, the people I have in class, many of them are very skilled, knowledgeable. So, that's another source. So it seems to be a lot more resources now..." Here is what it says in the notes about this issue (Session 3): "It looks like S. needs a lot of help, he gets it from staff members and D."

One reason why this could have happened might be due to workshop organization, lack of opportunity of experts' to fade their control. Primarily, learning occurs through interaction between experts and novices. In this process, the instructor (expert) has a goal, which is transferred to a learner by coupling their actions (Young et al., 1997). They work together for numerous trials through instructor providing continuous feedback to learners and receiving feedback from them. Eventually, the instructor has to fade the guidance or control of the learning process and become to monitor learner's actions. Accordingly, the learner needs to adopt new goals from the instructor and modify their own learning. Workshop learners might not have experienced such a "fading" process from the instructor during the workshop, and, therefore, they could have lacked an opportunity of adopting their new goals and modifying their own learning. This might have resulted in their dependency on experts.

Conclusions and Educational Implications

Since the data in this project were collected on a limited number of people, any generalization of these findings rests on readers to detect similarities of context.

Although more research needs to be done in exploring each of the findings, some recommendations are made for conducting similar multimedia workshops for in-service teachers.

1. The first finding revealed that participants had experienced positive conceptual change in their perceptions of PowerPoint, from it being a tool for teachers to it being a tool for students. To promote this change not only at a conceptual level but also at an applicational level of teachers' classroom practice, encouraging students to use PowerPoint as a learning tool should be emphasized.
2. It was found that the goals of participants changed from more general to more specific and/or realistic ones over a period of one semester. To promote these changes, it would be recommended to help participants identify their goals for each session and reflect on them regularly.
3. It was also revealed that participants' confidence in video and computer skills slightly improved. For future workshops, learning activities need to be specifically designed to increase participants' confidence.

4. It was found that a collaborative environment had developed among teachers. In order to create more elaboration among workshop participants, collaborative projects should be promoted by inviting more people from the same schools to work and learn together. Furthermore, spending more time on group activities rather than individual activities would be suggested.
5. Finding 5 indicated that participants showed some social attachment to their workstations. This feeling of partnership with computers should be respected, and, therefore, this human-machine collaboration should be supported in future workshops.
6. Based on findings 6 (Teachers' reported understanding of the educational value of video clips and the appropriateness of their use improved) and 7 (Teachers' reported understanding of the educational value of PowerPoint presentations did not change, most of them left with superficial conceptions of the use of PowerPoint presentations), it will be more useful to teach not just skills but educational concepts behind software and its use. In addition, for transfer to occur participants need help in identifying meaningfulness of a learning situation. This meaningfulness can be achieved through helping teachers identify projects relevant to participants' areas of professional interests and through presenting both successful and unsuccessful example presentations at the early stages of the workshop.
7. Based on finding 8 (Teachers developed dependency), it is recommended to encourage the use of Internet, manuals, and other resources to reduce dependency on workshop staff.

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Footnotes

[1]Layers refer to perceptual processes occurring simultaneously rather than sequentially.

[2]These two teachers were included in some of the data collection.

[3]Multimedia portfolios of eight participants were considered in this analysis.

Tables

Table 1

Confidence Decision Tree from the Information-Processing Point of View

Cognitive Processes	Information-Processing Sequence	Decisions
Use of sensory register, short term, and long term memory	Comprehending task demand (response scale) ⇓	No ⇒ Exit Yes ⇒ Go to phase 2
Use of sensory register, short term memory (STM), and long term memory (LTM)	Recognizing the meaning of the words for each item (declarative or procedural knowledge about this task or related tasks) ⇓	No ⇒ Exit Yes ⇒ Go to phase 3 ⇓
Use of STM; LTM retrieval and imagery	appraising the personal difficulty of the task by querying LTM ⇓	Go to phase 4 ⇓
Use of STM; LTM retrieval and imagery	Transferring the abstract appraisal to a specific number on the response scale	Respond between 1 and 5 on paper

Table 2

Results of Responses to Item 3

	Surface Structure	Tool for Students
Pretest	5	0
Posttest	3	2

Table 3

Number of Teachers Identifying General or Specific Goals

	General Goals	Specific Goals
Pretest	4	1
Posttest	3	2

Table 4

Results of Interview Responses about Changes in Confidence

	Video Skills	Computer Skills
More Confident	7	8
no Change	1	0

Table 5

Questionnaire Responses about Computer and Video Skills Confidence

	Video Skills (5-point scale)		Computer Skills (5-point scale)	
	Pretest	Posttest	Pretest	Posttest
Mean	2.4	3.0	2.8	3.2
SD	.894	.707	.447	.837
T-test (Significant)	.273		.373	

Table 6

Z-scores for Computer and Video Skills Confidence Responses

	Video Skills (5-point scale)				Computer Skills (5-point scale)			
Cases	Pretest	Pretest Z	Posttest	Posttest Z	Pretest	Pretest Z	Posttest	Pretest Z
1	1	-1.566	3	0	3	.447	4	.956
2	3	.671	4	1.414	3	.447	3	-.239
3	3	.671	3	0	3	.447	2	-1.434
4	2	-.447	3	0	2	.790	4	.956
5	3	.671	3	0	2	.790	3	-.239

Table 7

Results of Interview Responses to Question 4

	no	Vague Answer	Unclear	Dynamics of Process
Pretest	1	2	1	1
Posttest	0	1	0	4

Table 8

Results of the Interview Responses to Question 3

	Surface Structure	Tool for Students
Pretest	5	0
Posttest	3	2

Table 9

Results of the Responses to Question 2

	Experts	no Answer	Peers	Resources (Internet, Books, Manuals)
Pretest	2	1	0	2
Posttest	3	0	0.5	1.5

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